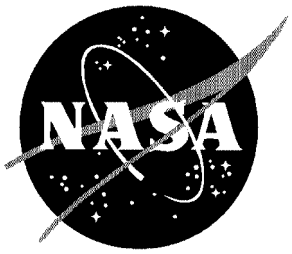

National Aeronautics and Space Administration

JULY 16, 2001
NRA 01-OSS-04

RESEARCH ANNOUNCEMENT

EXTRA-SOLAR PLANETS ADVANCED MISSION CONCEPTS

Notice of Intent Due: **AUGUST 17, 2001**
Proposals Due: **OCTOBER 12, 2001**

OMB Approval No. 2700-0087

EXTRA-SOLAR PLANETS ADVANCED MISSION CONCEPTS

NASA Research Announcement
Soliciting Basic Research Proposals

NRA 01-OSS-04
Issued: July 16, 2001

Proposals Due
October 12, 2001

Office of Space Science
National Aeronautics and Space Administration
Washington, DC 20546-0001

EXTRA-SOLAR PLANETS ADVANCED MISSION CONCEPTS

SUMMARY OF SOLICITATION

- INTRODUCTION

The stated mission of the Space Science Enterprise of the National Aeronautics and Space Administration (NASA) is to solve the mysteries of the universe, to explore the solar system, to discover planets around other stars, and to search for life beyond Earth. To carry out this mission, NASA's Office of Space Science (OSS) sponsors a broad range of research programs relevant to its four Science Themes, one of which is called the *Astronomical Search for Origins and Planetary Systems* (ASO) that addresses the origins of galaxies, stars, proto-planetary and extra-solar planetary systems, Earth-like planets, and the origin of life. (Further information about all of the OSS themes may be found through the OSS homepage on the World Wide Web at http://spacescience.nasa.gov .) In particular, this NASA Research Announcement (NRA) solicits proposals in support of the ASO theme through studying advanced mission concepts and technologies for missions to find and study Earth like planets.

Specifically, this NASA Research Announcement solicits proposals that develop any one of three types of investigation concept studies as follow: 1) for missions that can provide a deep survey for Earth-like planets around nearby stars, as well as a broad survey for more massive planets around more distant stars, and determine the masses of any Earth-like planets that are found; 2) for missions that can provide either scientific or technical support to the scientific aims of the Terrestrial Planet Finder (TPF) mission; and 3) for development and/or validation activities (either ground-based or through low-cost space flight) that will provide significant technology in support of the TPF mission science goals. Further details about these objectives are given in Appendix A and references therein.

These solicited concept studies are intended to stimulate the scientific community to provide OSS with alternate approaches to the goals of the planet finding related missions that are currently seen as preceding the TPF mission. In particular, OSS is seeking alternatives that will provide key science and technology inputs to the needs of the TPF mission development at significantly less cost than the missions that are currently in the OSS Strategic plan and ASO Roadmap, such as the Space Interferometry Mission (SIM) and Starlight (formerly ST-3).

Approximately $1500K will be available in Fiscal Year 2002 to fund up to six studies for six months, at which time NASA will review interim reports in order to exercise the option to continue up to four of these studies for a second six months at roughly the same level of funding per study. NASA intends to award a contract as the funding instrument for any proposals selected through this solicitation.

In all cases, the Government's obligation to make awards is contingent upon the availability of appropriated funds from which payment can be made and upon the receipt of proposals in response to this NRA that NASA determines are acceptable for award. Participation in this program is open to all categories of U.S. and non-U.S. organizations, including educational institutions, industry, nonprofit organizations, NASA Centers, and other Government agencies. Historically Black Colleges and Universities (HBCU's), other minority educational institutions, and small businesses and organizations owned and controlled by socially and economically disadvantaged individuals or women are particularly encouraged to apply. Participation by non-U.S. organizations in this program is encouraged subject to NASA's policy of no-exchange-of-funds (see further information in the "*OSS Guidebook for Proposers…*" discussed below).

• NEW INSTRUCTIONS FOR PREPARATION/SUBMISSION OF PROPOSALS

Starting in 1998, the Office of Space Science began to use a single, unified set of instructions for the submission of proposals for almost all of its NRA's that were incorporated into each NRA. Such standardization has proven to be of significant value to NASA to help ensure the uniform handling and processing of submitted proposals. However, starting in January 2001, these proposal policies and procedures, as well as those for NASA's review and selection of proposals for funding, are now described in a separate document entitled "*Office of Space Science (OSS) Guidebook for Proposers Responding to NASA Research Announcement – January 2001*" (abbreviated as "*OSS Guidebook – 2001*") that is accessible by opening "*Research Opportunities and Data*" from the menu at the World Wide Web URL http://spacescience.nasa.gov or may be directly accessed at URL:
http://research.hq.nasa.gov/code_s/ossguidebook/ossguidebook.html

By reference, *OSS Guidebook – 2001* is hereby incorporated into this NRA, and proposers to this NRA are responsible for understanding and complying with its procedures before preparing and submitting their proposals. In particular, Chapter 2 ("Proposal Preparation and Organization") and Chapter 3 ("Proposal Submission Procedures") largely replace the contents of "Appendix C" in most OSS NRA's issued during the previous three years. Proposers familiar with these recent OSS NRA's will find that these instructions are essentially unchanged from those introduced starting in 1998, although the material is rearranged somewhat. Also note, that the NASA-required proposal *Budget Summary* form is now available electronically through the Web site designated for the *Cover Page/Proposal Summary* (see Summary Information below) for printing in hard copy for submission with the hard copies of the proposal. The other chapters and appendices of *OSS Guidebook – 2001* provide supplemental information about the entire NRA process, including NASA policies for the solicitation of proposals (including those involving non-U.S. participation), guidelines for writing complete and effective proposals, the NASA policies and procedures for the proposal review and selection processes and for issuing and managing the awards to the institutions that

submitted selected proposals, and Frequently Asked Questions (FAQ's) about a variety of proposal and award processes and activities.

Comments and suggestions of any nature about *OSS Guidebook – 2001* are encouraged and welcomed and may be directed at any time to Dr. J. David Bohlin, Research Program Management Division, Code SR, Office of Space Science, NASA Headquarters, Washington, DC 20548; telephone: 202/358-0880; E-mail: david.bohlin@hq.nasa.gov (if submitted by E-mail, use "Proposer's Guidebook" without quotations as the Subject of the message).

• OSS EDUCATION AND PUBLIC OUTREACH (E/PO) PROGRAM

OSS policy continues to strongly encourage participation by the space science community in education and public outreach activities with the goal of enhancing the Nation's formal education system and contributing to the broad public understanding of science, mathematics, and technology. A significant national program in space science education and outreach is now underway, and OSS's demonstrated contributions to education and outreach have now become an important part of the broader justification for the public support of space science (for further details open "*Education and Public Outreach*" on the OSS homepage at http://spacescience.nasa.gov).

Since 1998, when it started to offer the opportunity to propose E/PO activities in conjunction with its NRA's, the Office of Space Science has received many constructive comments from members of the space science community as to how to improve its efforts to involve space scientists in education and public outreach. Based on the experience of the past few years and these comments, OSS is making a number of important changes in procedure this year. In particular, for OSS NRA's released starting in January 2001, E/PO proposals for additional funding for this activity will be solicited only from those proposers whose research proposals have been already selected for an award. This change should decrease the overall workload on the space science community, increase the likelihood that more E/PO proposals of merit will be funded, and more effectively encourage successful science proposers to add an E/PO component to their research effort.

Therefore, only those proposers to this NRA who are eventually selected on the basis of the excellence of their research awards will be eligible to propose a supplemental E/PO program in accord with the OSS E/PO policies and guidelines. At the time of the release of this NRA, it is currently planned that selected Principal Investigators will have two windows of opportunity to submit an E/PO proposal, either: (i) no later than 45 days after the date of the letter of selection of their parent research proposal, with the anticipation of starting the proposed E/PO activity within the first third of the first year of the parent research award; or (ii) no later than 75 days before the yearly anniversary date of their award, with the anticipation of starting the proposed E/PO activity in conjunction with next yearly funding supplement of their multiple year award. In either case, consistent with the past E/PO policies and to ease the burden of NASA's administration of these

supplemental awards, the total period of performance of an E/PO award will be restricted to that of its parent research award.

The current description of the underlying strategy and implementation plans for the OSS E/PO program may be found through the menu item *Education and Public Outreach* on the OSS homepage at http://spacescience.nasa.gov. The specific policies and procedures for writing and submitting supplemental E/PO proposals in conjunction with proposals selected through this NRA will be posted no later than the end of July 2001, which will be sufficiently early to allow those selected to organize and submit an E/PO proposal. Questions and/or comments about this OSS E/PO program are sincerely welcomed and may be directed to Dr. J. David Bohlin, Research Program Management Division, Code SR, Office of Space Science, NASA Headquarters, Washington, DC 20546 (telephone: 202-358-0880; E-mail: david.bohlin@hq.nasa.gov)

• ITEMS OF SPECIAL IMPORTANCE

(1) OSS now requires the electronic submission of certain key elements of proposals through the World Wide Web (see below in the Summary Information), and this practice continues with this NRA. While every effort is made to ensure the reliability and ease of accessibility of this Web site, and to maintain a point of contact for assistance via E-mail, difficulty in accessing and/or using this site may arise at any point on the Internet including the user's own equipment. Therefore, prospective proposers are urged to familiarize themselves with this site and to submit the required proposal materials well in advance of the deadline(s) of the program element(s) of interest.

(2) OSS maintains an electronic notification system to alert interested subscribers of the impending release of its research program announcements. Subscription to this service is accomplished through the menu item *Get E-mail Announcements* on the OSS home page at http://spacescience.nasa.gov by following the instructions for *Space Science Research Announcements*. Owing to the increasingly multidisciplinary nature of OSS programs, this electronic service will notify subscribers of all future NASA OSS program announcements regardless of its type and objective (10 to 15 per year). Regardless of whether this service is subscribed to or not, all OSS research announcements may be accessed from the Web as soon as they are posted (about 8:30 a.m. Eastern Time on the day of release) through *Research Opportunities and Data* on the OSS homepage.

SUMMARY INFORMATION

• Program Alpha-Numeric Identifier	NRA 01-OSS-04
• Date of NRA Issue	July 16, 2001
• Guidance for Preparation and Submission of Proposals (including default page limits)	"*OSS Guidebook for Proposers*" http://spacescience.nasa.gov/research/ossguidebook/
• *Notice of Intent (NOI) to Propose*:	
- Desired Due Date	August 17, 2001
- Web Site for Electronic Submission	http://props.oss.hq.nasa.gov (Help Desk: deb.tripp@hq.nasa.gov)
- Late Submission	Submit information specified in Section 3.1 of *OSS Guidebook for Proposers* by E-mail to deb.tripp@hq.nasa.gov
• *Cover Page/Proposal Summary*:	
- Deadline	October 12, 2001
- Web Site for Electronic Submission	http://props.oss.hq.nasa.gov (open for use ~ 45 days prior to Proposal Deadline (Help Desk: deb.tripp@hq.nasa.gov)

• Web Site for Download of Proposal *Budget Summary* Form	http://props.oss.hq.nasa.gov (Help Desk: deb.tripp@hq.nasa.gov)
• Submission of Printed Proposal (including printed *Cover Page/Proposal Summary* and *Budget Summary*):	
- Required Number	Signed original proposal plus 15 copies.
- Deadline	5 p.m. Eastern Time, October 12, 2001
- Address for Submission by U.S. Postal Service, Commercial Delivery, or Private Courier	**Extra-Solar Planets Advanced Missions** NASA Peer Review Services Suite 200 500 E Street, SW Washington, DC 20024 Telephone: 202/479-9030
• Selecting Official	Director Astronomy and Physics Division Office of Space Science
• Announcement of Selections	Goal: 150 days after Proposal Deadline
• Initiation of Funding for New Awards	Goal: 46 days after Announcement of

	Selections
• Further information	**Dr. Philippe Crane** Astronomy and Physics Division Code SZ Office of Space Science National Aeronautics and Space Administration Washington, DC 20546-0001 Phone: (202) 358-0377 E-mail: philippe.crane@hq.nasa.gov

These studies of mission concepts and technologies present an exciting opportunity for the advancement of the NASA OSS ASO science theme. Your interest and cooperation in responding to this NRA are appreciated.

Anne L. Kinney
Science Theme Director
Astronomical Search for Origins and Planetary Systems

After July 1, 2001:
Director
Astronomy and Physics Division
Office of Space Science

APPENDIX A

DESCRIPTION OF RESEARCH OPPORTUNITY

1.0 Scope of Program

The goal of this NRA is to solicit studies of innovative concepts that can fulfill the objectives given below with regard to the development of advanced mission concepts and technologies in support of the Terrestrial Planet Finder (TPF); the baseline science program for the TPF mission is contained in the *TPF Draft Reference Program* on the Web at http://tpf.jpl.nasa.gov. The proposed efforts are expected to include the scientific and technical description of the concept to be studied, the identification of a sample development plan, and an estimation of the cost to execute the concept should it ever be approved for development by NASA. It is understood that some of the research into mission and/or technology concepts developed through the selected studies may be used by NASA to formulate solicitations (an Announcement of Opportunity and/or a NASA Research Announcement) by the Office of Space Science (OSS).

The concept studies solicited through this NRA are intended to stimulate the scientific community to provide OSS with alternate approaches to the goals of the missions that are currently seen as leading to the TPF mission. In particular, OSS is seeking alternatives that will provide key science and technology inputs to the needs of the TPF mission development at significantly less cost than currently planned missions such as the Space Interferometry Mission (SIM; see http://sim.jpl.nasa.gov) and Starlight. This NRA is specifically not to develop mission concepts for TPF itself, but rather to stimulate mission concepts, investigations, and technologies that will be needed in order to fulfill the TPF mission objectives.

1.1 Objectives

This NRA solicits proposals for concept studies for any of three types:

- Type 1 investigations: Concept studies of science missions that can provide as many of the planet finding objectives of the SIM mission as possible. These objectives include a survey for Earth-like planets around a substantial number (hundreds) of nearby stars (within roughly 20 pc.) as well as a survey for more massive planets around other stars at greater distances. The mission must determine the masses of any Earth-like planets that may be found.
- Type 2 investigations: Concept studies of science missions that can provide scientific or technical inputs important for the development of the Terrestrial Planet Finder (TPF) mission and/or act as a precursor to the TPF mission.
- Type 3 investigations: Concept studies of activities that would provide technology input to the TPF mission, but that are of a reduced scope and cost compared to Type 2 investigations and that do not necessarily require a space flight project for validation, although validation through a low cost flight is not precluded.

A mission that might fit the performance profile of a Type 1 study would be the SIM as it is currently conceived. However, this NRA is soliciting studies of concepts for missions that can provide the same or better scientific return utilizing improved methodologies and/or technologies while significantly reducing the mission cost and/or risk. Therefore, proposers should consider missions whose Phase B/C/D plus launch vehicle costs fall in the range of $500M or less in constant Fiscal Year (FY) 2001 dollars.

A mission that might fit the profile of a Type 2 study would generally conform to the cost and schedule cap of the Discovery type missions ($\leq$ $300M in FY 2001 dollars) and would address critical technologies or provide unique scientific input needed for the design and construction of the TPF mission. Examples of critical technologies that might be tested are precision formation flying of two or more satellites, testing designs for optical beam transport between separated spacecraft, demonstrating interferometric nulling techniques in space, and the demonstration of a high contrast imaging optical imaging system in space. Technology studies should consider a wide range of potential areas that might contribute to the concept and design of TPF, for example the measurement of the frequency and brightness of zodiacal dust clouds around particular types of stars and the determination of the probability of finding a planetary system that supports planets in the so-called "habitable" zone.

Studies that fit the profile of Type 3 proposals are the development of critical technologies for TPF that could be tested on the ground or as a low cost payload for space flight that could be funded within a total cost of $80M (FY 2001 dollars) or less over three to five years (i.e., equivalent to a Small Explorer (SMEX) mission).

2. Programmatic Considerations

Recommendations for the funding of the proposals selected through this NRA will be based on the peer evaluation of each proposal measured against the criteria given in Section C.2 of Appendix C of the *OSS Guidebook for Proposers*, with the understanding that the evaluation of a proposal's technical merit will include the factors given in the Section 3 below.

Approximately $1500K is expected to be available in Fiscal Year 2002 (FY 2002) to support up to six selections at a maximum cost of up to $250K per study for six months. It is anticipated that approximately $1000K may be available in FY 2003 to continue up to four of the initial studies for a second period of six months. In order to carry out this two-step plan of support, proposals should be budgeted for one full year of effort at a cost not to exceed the order $500K, with a break point planned after six months. A detailed Interim Progress Report, not to exceed 20 pages in length (one sided, single spaced) plus appendices, not to exceed 10 pages, will be due after five months from the initiation of each award. This Interim Report will be evaluated by NASA to determine if the second six month period will be funded. It is NASA's intent to initiate funding of all proposals selected through this NRA at the same time so that these Interim Reports may be

evaluated in a competitive manner. Further funding of those efforts not selected on the basis of their Interim Reports will be terminated after the end of the first six month period. For those tasks authorized for a second six months of support, a Final Progress Report, not to exceed 30 pages (one sided, single spaced), plus appendices, not to exceed 20 pages, will be due at the end of the period of performance.

It is to be clearly understood that there is no commitment by OSS to fund the actual formulation and implementation of any potential missions or technology activities studied through any of the proposals selected through this NRA. If OSS decides to pursue any of the concepts studied through this NRA, NASA reserves the right to use the results of their studies to develop an appropriate solicitation to which any interested proposers may respond. In such a case(s), the relevant Final Progress Report(s) submitted by the awardee(s) through this NRA will be included in the Document Library associated with that solicitation. Alternatively, a team selected through this NRA for a concept study may elect to compete in one of the routinely released OSS AO's for the Discovery or Explorer programs should their proposed effort fit the guidelines of those solicitations.

Potential offerors are encouraged to form teams including U.S. academic, and industrial, organizations, Government research centers (including NASA Centers and the Jet Propulsion Laboratory), and non-U.S. organizations.

3. Proposal Content

Proposals must follow the guidelines for format and length specified in Guidebook for Proposers. (See references in the *Summary Information* in the Summary of Solicitation of this NRA).

The body of the proposal should contain the following information:

- Clear indication of the Type (1, 2, or 3) of concept study that is being proposed;
- A description of the relevance of the proposed concept to the scientific goals of the TPF mission;
- A description of the technical solution proposed and how this would further the scientific goals of the TPF mission, including the level of technical maturity of any proposed mission or technology development concept; and
- A budget and management plan that breaks the effort into two six month periods, with a Interim Progress Report due at the end of the first five months, and a Final Progress Report due at the end of the 12 month period of performance should the second phase of the effort be funded..

Evaluation of the technical merit of the proposal will specifically take into account the following factors:

- For proposals of Type 1, the nature of the science capability envisioned, the nature of the technical approach, the expected rate of degradation of the planet detection precision with increasing stellar distance, the approach for determining planetary masses, and the basis for asserting a cost $\leq$ \$500M.
- For proposals of Type 2, the scientific and/or technological linkage to the goals of TPF and the basis for asserting a mission cost $\leq$ \$300M.
- For proposals of Type 3, the linkage of the proposed technology development to the goals of TPF, the approach to be taken in developing and testing the technology, and the basis for the estimated cost for this test (including a low cost flight mission if necessary).